



Guidelines for Soil and Groundwater Sampling - Brownfields/Voluntary Cleanup Program

This fact sheet is intended for use by participants in the Brownfields/Voluntary Cleanup Program. The following soil and groundwater sampling procedures are not intended to serve as a comprehensive standard operating procedure, but rather a list of guidelines to address common sample collection errors.

Soil Sampling

- **Headspace Readings (Field screening using a photoionization detector, or PID)**

Prior to analysis, the sample should be manually shaken or agitated for 15 to 20 seconds. The agitation period should be consistent for all samples collected at the sample site. If the ambient temperature is below 32 degrees Fahrenheit, the sample should be placed in a heated vehicle or a building for five to ten minutes prior to analysis. The collection of volatile organic compound soil samples should not wait for the headspace readings to be completed for each interval, so be prepared with extra SW-846 Method 5035 kits.

- **SW-846 Method 5035**

All soil samples to be analyzed for volatile organic compounds must be collected in accordance with SW-846 Method 5035. In addition, volatile organic compound samples shall not be acid-preserved or homogenized. Instead, samples should either be preserved using trisodium phosphate dodecahydrate, or TSP, or by adding deionized water to the sample followed by freezing the sample. If the latter option is chosen, it is imperative the sample be rapidly cooled in the field to at or below 4 degrees Celsius followed by the receiving laboratory freezing the sample soon after. While Method 5035 stipulates sodium bisulfate be used to preserve soil samples, the Missouri Department of Natural Resources has modified the method by requiring preservation using TSP.

For further information, please refer to the department's fact sheet *MO Risk-Based Corrective Action for Petroleum Storage Tank Sites — Preservation of Samples Analyzed for Volatile Organic Compounds* online at www.dnr.mo.gov/pubs/pub2159.pdf.

Groundwater Sampling

- After well development, monitoring wells should be allowed to stabilize for at least 24 hours before sampling.
- Well construction diagrams should be as-built diagrams (based on **measured** post-installation total depths).
- A slotted screen must be used in temporary wells. Groundwater samples should not be collected from an open bore hole.
- Generally, the length of a monitoring well screen should be no more than 10 feet.

- Groundwater sampling activities should be thoroughly documented on sampling forms or in field notes (including stabilization criteria).
- Groundwater samples to be analyzed for volatile organic compounds shall not be acid-preserved. Instead, volatile organic compound samples should be preserved by either TSP or rapid in-field cooling to at or below 4 degrees Celsius followed by freezing by the receiving laboratory soon after.
- Groundwater Sampling Methods
 - Low-flow/Passive Sampling
Low-flow methodologies or passive samplers should be used for groundwater collection. *Low-flow purging* is intended to remove water from the screened section of the well and allow fresh formation water into the well while minimizing agitation and mixing with stagnant water within the well above and below the screen. Water levels must be monitored to ensure minimal drawdown (0.2 to 0.3 feet) and thus, minimal flow from the solid casing region. Water quality parameters (e.g., temperature, dissolved oxygen, pH, specific conductance, turbidity) must be monitored and purging is complete when selected parameters have stabilized.

Passive samplers acquire a sample from a discrete position within a well with little or no agitation of water within the well. They must remain submerged during a specified deployment period (dependent on the time required for the sampler to equilibrate with ambient water) and are intended to collect a sample representative of formation water directly adjacent to the well screen. The representativeness of the sample is dependent on horizontal flow of groundwater through the screen. Passive samplers can be deployed at one or more depths within the screened interval to evaluate contaminant concentrations at one or more points within the screened interval.

Refer to the following for references for further information:

- EPA Low Flow Groundwater Sampling Procedures
www.epa.gov/tio/tsp/download/lwflw2a.pdf
- ITRC Diffusion/Passive Sampler Documents
www.itrcweb.org/guidancedocument.asp?TID=12
- Bailers/Pumps
Current research indicates bailers are not the best available technology to collect groundwater samples. Studies have demonstrated that levels of volatile organic compounds in samples obtained with bailers are statistically lower than in samples obtained with other devices. In addition, bailing can cause increased turbidity.

The use of inertial lift pumps (e.g., Waterra, hand pumps) for sample collection is not recommended because they create a surging action, which may cause increased turbidity, loss of volatiles, aeration and degassing of samples.

Peristaltic pumps should be used with caution, as the vacuum created may cause volatilization and degassing in gas-sensitive or volatile samples.

Sample tubing should be selected carefully, as some flexible sample tubing (e.g., silicone and tygon) may leach plasticizers or adsorb or desorb organic compounds.

Bailers and peristaltic pumps are acceptable only in certain situations, such as grab samples from temporary wells and only with prior approval from the Brownfields/Voluntary Cleanup Program. When these methods are used, sampling personnel need to be properly trained since sampling results are highly dependent on the skill, care and consistency of the person collecting the samples. With bailers, great care must be taken to slowly and gently lower and raise the bailer in and out of the water column, and, when samples are to be analyzed for volatile organic compounds, a bottom emptying device must be used to decant samples to their respective volatile organic compound vials. With peristaltic pumps, a low flow rate (0.1 to 0.5 liters per minute) must be used to minimize volatilization. Research has shown that low lifts, low pumping rates and using non-sorptive tubing such as Teflon minimize the negative effects these pumps can have on a sample.

- If groundwater samples are being analyzed for metals, field filtering is allowed as long as any preservation (especially with acid) is done *after* filtering. The program recommends using a 5 µm in-line filter. However, please note that the use of low-flow groundwater sampling methods consistently produce samples with no statistical difference between filtered and unfiltered samples, obviating the need for field filtering.
- In all cases, samples need to be preserved immediately in a cooler with ice.
- All samples must be collected in accordance with an approved Quality Assurance Project Plan and appropriate quality assurance/quality control samples, such as duplicates and trip blanks, must be included. While participants are free to submit a site-specific Quality Assurance Project Plan, this level of effort is not required for most Brownfields/Voluntary Cleanup Program sites. To help participating sites meet this requirement while maintaining the streamlined efficiency for which the Brownfields/Voluntary Cleanup Program is known, the program has developed a generic Quality Assurance Project Plan for use by participants and their consultants. The plan is available online at www.dnr.mo.gov/env/hwp/qapp/index.htm. A site-specific Quality Assurance Project Plan Addendum form is available to outline site-specific changes to the generic plan.

For more information

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